The Ohio Journal of Science

Vol. XX FEBRUARY, 1920 No. 4

A PRELIMINARY SURVEY OF THE PROTOZOA OF MIRROR LAKE, ON THE OHIO STATE UNIVERSITY CAMPUS.

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CONTENTS.

INTRODUCTION.

The present study, while it marks only the beginning of a thorough survey of the protozoan fauna of Mirror Lake, is an attempt to add a little to the sum total of our knowledge regarding the ecological relationships of the Protozoa. The period of study, which extended from early October, 1917, to the end of March, 1918, was clearly too limited to permit drawing any far-reaching conclusions; but even in this limited time it was possible to make many interesting observations which, it is hoped, will prove of value.

The classification adopted in this paper is largely that employed by Calkins in his work on "The Protozoa," published in 1901.

It is the writer's pleasant duty to thank those who have helped make it possible for her to do this work. She is indebted for much help and many valuable criticisms to Mr. W. J. Kostir, under whose supervision the work was done. Her thanks are due also to the following: To Dr. R. C. Osburn, for naming the fishes of Mirror Lake; to Dr. Freda Detmers, for naming the larger plants; and to Dr. E. N. Transeau, who named the algae.

METHODS OF STUDY.

Since the collections were made at or near the shore, a very simple outfit sufficed. This included a pipette one foot long, another very short one, a spoon for scraping algae from stones and wood and lifting material from the bottom, a thermometer, and tumblers. Several stations were selected, with the idea of obtaining environments as varied as possible. These included those parts of the water constantly shaded, those shaded only a part of the day, water containing much decayed material, algae and sediment in clear spring water, algae growing on submerged wood, and those on submerged rocks. Sediment was collected in water a foot or more deep and from leaves submerged but a few inches. Floating as well as submerged plant material was taken. The material was examined as soon as possible after it was collected and then every few days for a period of a month or more. When an animal appeared only after the culture had been standing in the laboratory, this fact is mentioned when the particular animal is discussed. Collections were made once a week when possible, though this rule could not always be adhered to, partly because of lack of sufficient time, partly because of the weather. It will be remembered that the winter of 1917-18 was an unusually severe one.

Reports on atmospheric temperature, degree of cloudiness, and other weather conditions were obtained from an office of the United States Weather Bureau, situated on a hill overlooking Mirror Lake. Since the limited duration of the study made impracticable any attempt to establish correlations between the appearance or disappearance of various forms and the weather conditions, only a brief summary of the latter will be given.

Relatively few clear days are recorded for the time between October 1, 1917 and February 28, 1918. In March, the sky was clear perhaps half the time. The precipitation was below normal during most of the period; in October and January it rose somewhat above the normal for this region. The temperature showed a pretty steady fall until early in December, when the mean daily temperature went below zero Fahrenheit for the first time. Exceptionally severe weather continued throughout December, January, and the first part of February.

During this period, snow was on the ground almost continuously, and ice covered the lake. After February 9, coincident with clearer weather, there were consistently higher temperatures, and the snow and ice disappeared.

DESCRIPTION OF MIRROR LAKE.

"Mirror Lake" is a small artificial pond situated in a natural ravine on the Ohio State University campus. Through this ravine a creek formerly flowed from the east and emptied into the Olentangy river nearly half a mile west of the present lake site. In 1872 a sewer was built which drained the creek; and about the same time the lake bed was excavated. The lake's supply of water came from springs which had formerly fed the creek. In 1895 all the water in the lake was emptied, most of the animal and vegetable life was destroyed, and the lake bed was enlarged by the addition of the small arm at its northwest end. Since that time fishes, aquatic plants, and other forms of life have been introduced into the pond.

Mirror Lake is made up of two bodies of water, separated only by a very narrow neck of land four feet wide (Plate I). These will be referred to as the smaller pond and the larger pond. A rapidly ascending grassy slope, covered with bushes and trees, on the north side and a gently rising one on the south side partly enclose the lake; the former is 25 feet high and the latter 27 feet. West of the lake the ground rises about nine feet to the roadway, which is about 50 feet distant; while on the east the rise is extremely gradual.

The smaller pond is at most 50 feet wide (from north-east to south-west) and 140 feet long (from north-west to south-east). The springs on the north shore furnish it with a not very copious supply of water; and the outlet is through a six inch pipe at its north-west end. Only after a heavy rain does the water in this pond reach a height sufficient to carry some of it through this pipe into the larger pond. The average depth in the smaller pond is about one and a half feet; the depth in the deepest part does not exceed two and one-half feet. The level of the water is usually about one foot higher than in the larger pond. The bottom is covered with fine black sediment and decaying leaves. More decay goes on in this pond than in the other. Many tall white poplars (*Populus alba* Linnaeus) shade this part of the lake from the sun, except

for a short time in the morning and again in the late afternoon. In October, burr marigold (*Bidens laevis* Linnaeus) grew plentifully along the water's edge; this disappeared when the cold weather came on. Duckweed (*Lemna trisulca* Linnaeus) formed a compact green mat over the surface of the water at several places along the edge; it was present throughout the winter, but became scanty when ice formed on the lake. Several plants of the water hyacinth (*Eichornia* sp.) floated in this pond. Minnows (*Lepomis pallidus* (Mitchill) swarmed here during the fall; large water beetles (*Dytiscus*) were numerous; and many water striders (*Gerris*) scampered on the surface of the water.

Weather conditions affected the appearance of the water in the smaller pond considerably. In the early part of October when the study was begun, most of the water was bright green in color, due to the extreme abundance of the flagellate *Carteria multifilis*. This organism became active when the sun shone upon the pond, but settled to the bottom and made a thick green sediment on the leaves when the water was shaded from the sun. Late in October after a heavy storm the organism disappeared. For two months during the winter a heavy sheet of ice covered this part of Mirror Lake.

The larger pond is at most about 350 feet long (from north-east to south-west) and 116 feet wide (from north-west to south-east). The average depth of water is between two and two and one-half feet. A large spring (J) just north of the eastern end of the larger pond is its largest source of water. In addition, drainage water from the surrounding slopes, occasionally water from the smaller pond, and probably water from small springs in the lake bed help supply this part of Mirror Lake. The water of the large spring bubbles into a cement bowl, which is set in the cement walk. It overflows into a small gutter which carries the water to the lake, about six feet distant. The shore at this point is covered with large boulders, the submerged part of which is covered by algae (mostly *Spirogyra*). The bottom here is sandy; at the point of inflow from the smaller pond it is covered by a thick layer of fine black sediment; while in the remainder, small stones, some dead leaves, greenish brown sediment, and algae cover the bottom. The outlet of this pond is through a six-inch pipe at the southwest end; the

height of water in this pipe varied from nine-sixteenths to one and seven-eighths inches during the period of study.

The shore of the larger pond is steep, and the soil of the bank is firm as contrasted with the loose marshy earth around the smaller pond. The distance from the ground level to the surface of the water averages about one foot.

The larger pond is shaded only at a few places along the shore where there are overhanging trees. There is a white poplar (*Populus alba* Linnaeus) just east of the spring, and its alga-covered roots, which extend into the water, form a habitat for many Protozoa. An alder tree (*Alnus incanus* Linnaeus) shades the water just west of the spring.

The goldfish (*Carassius auratus* Linnaeus) is very abundant in this part of Mirror Lake. During the time when ice covered the lake, these collected near the outlet of the spring, for here the water never froze. At this point the caretakers occasionally throw food (usually dry bread) to them. Tench (*Tinca tinca* Linnaeus), carp (*Cyprinus carpio* Linnaeus), and minnows (*Lepomis pallidus* (Mitchill)) are plentiful, but occur in smaller numbers than do the goldfish. Common brown rats (*Mus norvegicus* Erxleben) and muskrats (*Fiber zibethicus* Linnaeus) live in burrows along the shore. The water snake (*Natrix sipedon* Linnaeus) was seen once. Frogs and crayfishes are common. Algae were common during most of the period of study. The most common were *Spirogyra fluviatilis*, several species of *Oedogonium*, *Scenedesmus quadricauda*, *Pediastrum*, and *Ankistrodesmus*.

Descriptions of the Stations.

Station A.

Sediment on decaying leaves in stagnant, shaded water.

This station was near the east edge of the smaller pond where the water is quiet, more or less stagnant, and from three to four inches deep. The sun shone here only for a few hours in the morning; tall white poplars (*Populus alba* Linnaeus) shaded the water for the remainder of the day. Throughout October, the decaying leaves on the bottom were covered by a thick green sediment. The leaves were carefully lifted and this sediment allowed to drain off into a tumbler. Examination showed this color to be due to enormous numbers of a small

green flagellate, *Carteria multifilis*. At the end of the month, following a heavy storm, all the sediment on the leaves disappeared, and for this reason collecting was discontinued at this station.

The colonial flagellate *Synura uvella* was common in this sediment. The larger ciliates, *Loxodes rostrum, Stentor polymorphus, Paramaecium caudatum* and *Spirostomum ambiguum* were conspicuous.

STATION B.

Black sediment at bottom, in stagnant, shaded water.

Station B was at the extreme southeast edge of the smaller pond, very close to the preceding station, as is shown by the similarity of forms taken at the two localities. The water was full of decaying leaves and was three inches deep. It was shaded throughout the day, except for a few hours in the early morning. In early October, when collecting began at this station, the water was covered by a compact mat of duckweed (*Lemna trisulca* Linnaeus) which shut out the light almost completely from the water beneath. As the temperature lowered, this plant became scanty, but never entirely disappeared. A pipette was inserted between the duckweed and the fine black sediment from the bottom was taken for examination. *Carteria multifilis* was present in this material during October, but was not nearly so abundant as at Station A. The larger ciliates, *Loxodes rostrum, Frontonia leucas*, and *Spirostomum ambiguum* were common.

STATION C.

Floating algae, in water well exposed to light.

This station was on the west side of the peninsula which extends into the larger pond. The water was about six inches deep, contained little decaying material, but often became turbid. The sun shone on this part of the lake throughout the day. In October an abundance of algae (mostly *Spirogyra*) floated at the surface and some of these were taken for examination. They became less plentiful as cold weather came on, until in December they entirely disappeared. In February, after the ice had melted, the algae resumed growth. The ciliates and flagellates were well represented at this station during the fall and again in February. The most abundant

of the former were *Epistylis flavicans*, *Stylonychia mytilus*, and *Urocentrum turbo*. The flagellates *Chilomonas paramaecium*, *Trachelomonas volvocina* and *Peranema trichophorum* were plentiful. Several species of *Difflugia* were taken; these multiplied rapidly in the laboratory.

STATION D.

Alga-covered roots in clear water well lighted much of the time.

Station D was on the north shore of the larger pond just east of the spring. The shore is steep and the water is about a foot and a half deep. It was quiet and clear, and the sun shone here all the afternoon. The temperature of the water never became lower than one degree centigrade, due to the proximity of this station to the spring. A white poplar (*Populus alba* Linnaeus) overhangs the lake here and its roots extend into the water. These were thickly covered by algae (largely *Oedogonium*), which harbored many Protozoa. *Arcella vulgaris*, *Raphidiophrys pallida*, *Acanthocystis* sp. and *Amoeba radiosa* were the most plentiful rhizopods; *Cyclidium glaucoma*, *Coleps hirtus*, *Paramaecium caudatum*, *and Lionotus fasciola* represented the ciliates well; some few flagellates were taken, but they were not plentiful.

STATION E.

Sand and algae in clear, fresh, slowly running water, well exposed to light.

Station E was located at the point where the water from the spring entered the larger pond. The water was about two inches deep, clear, fresh, and always in motion. Ice never formed here, because of the uniformity in temperature of the spring water, which varied between six degrees and twelve degrees centigrade. This locality was never shaded from the sun. Large boulders covered the shore, and below the water line these were covered by a scanty growth of algae (mostly *Spirogyra*). Collections were made here in two different ways: algae were scraped from the rocks, and some of the sand was taken with a pipette. This station was an ideal habitat for rhizopods. Throughout the period of study, the following were common: *Amoeba limax*, *Amoeba radiosa*, and *Actinophrys sol*. A number of others were taken, but they were infrequent in collections. A few ciliates occurred, but their number was

far below that of those taken at stations where more decaying material was present. One suctorian, *Sphaerophrya urostylæ*, occurred frequently.

STATION F.

Greenish brown sediment at bottom, in a spot well exposed to light most of the time, but shaded partly by floating algæ.

This station was located at the same place as Station C, but the mode of collection was different, sediment from the bottom being taken. The water was about six inches deep and a large mass of algae floated at the surface during part of the period of study. The presence of a thick sheet of ice for about two months did not interfere with the collecting at this station. The pipette was inserted through a hole in the ice, and the sediment taken from the bottom. This sediment was always plentiful and of a greenish brown color. The flagellates *Euglena* sp.? and *Euglena deses* predominated here, although they never became abundant. *Carteria multifilis* was plentiful during October.

STATION G.

Algae on submerged rock in clear water, well exposed to light.

This station was located in the larger pond on a large flat boulder about two feet from the shore and just east of the spring. The submerged portions were thickly covered with algae (mostly *Spirogyra fluviatilis*). The water was clear and was shaded for only a part of the morning. Because of the proximity of this station to the spring, ice never became thick enough to interfere with collecting. About this stone the goldfish collected in large schools, for here the caretaker threw drieds bread to them occasionally. Algae were scraped from this stone and examination of this material showed a remarkable variety of forms throughout the period of study. *Phacus pyrum*, *Coleps hirtus*, *Prorodon teres*, *Strombidium gyrans*, and *Aspidisca costata* were plentiful in this locality. *Stentor coeruleus* was so abundant during January that it formed a blue scum over the algae.

STATION H.

Dead algae (Oedogonium) *forming a bright yellow, flocculent mass on bottom. Spot well lighted most of the day.*

Station H occupied a position near the east shore of the bay in the east end of the larger pond. The water here was quiet, about three inches deep and was shaded during only a few hours in the morning. Passing by this part of Mirror Lake, my attention was attracted by a mass of bright yellow flocculent material which covered the bottom. My interest was aroused to know what it was and what Protozoa were present in it. Some of the material was lifted into a tumbler with a spoon. Examination showed it to consist of dead filaments of the alga *Oedogonium*. This remained abundant as long as the temperature of the water stayed below five degrees centigrade; when it became warmer than that, the living green alga had resumed its growth. The flagellates which predominated were *Euglena viridis*, *Peridinium tabulatum* and *Synura uvella*. *Lembadion bullinum*, a ciliate, was plentiful and was taken exclusively at this station. *Pleuronema chrysalis* found an ideal habitat among this decaying material.

STATIONS I AND I′.

Algae covering submerged wooden posts, on different sides of the pond, but both well exposed to light.

Two submerged wooden posts on opposite sides of the larger pond, but apparently showing similar conditions, were selected for these stations. The sun shone on both of them throughout the day and the temperature of the water was the same in both places. A thick growth of algae (mostly *Oedogonium*) covered the posts below the surface of the water. This was scraped off and the two collections each time were compared with each other. It was interesting to note that approximately the same Protozoa were found in both places at the same times, despite the distance between the stations. The heliozoan *Raphidiophrys viridis* was abundant in November. *Holosticha vernalis*, *Stentor roeselii*, *Frontonia* sp.? and *Euglena* sp.? were common at these places throughout the period of study.

STATION J.

Algae and sediment in clear, fresh spring water, well exposed to light.

Station J was located just north of the east end of the larger pond, in the cement bowl into which the spring bubbles. The

overflow of water from the bowl is carried to the larger pond through a small gutter. This place was not shaded at any time of the day. Although the bowl was cleaned occasionally by the caretakers, a scanty growth of algae was always present on its sides. This material, together with the sediment which it contained, was taken. Examination showed it to contain an abundance of rhizopods. *Actinophrys sol*, *Nuclearia* sp.? and *Amoeba radiosa* were most plentiful. Many others were taken occasionally.

STATION K.

Greenish brown sediment and algae on large submerged stone in turbid waters, well lighted during part of the day.

This station was added to the list late in February. It was located about a foot to one side of the outlet of the larger pond. This spot receives direct sunlight in the morning and in the late afternoon; the water was relatively quiet, but turbid, and about three inches deep. Greenish brown sediment and algae were taken from the large submerged stone at this place. *Aspidisca costata*, *Chilodon cucullus* and *Stylonychia mytilus* were common at this station during the period of study.

STATION L.

Algae on submerged stone in shallow, turbid water, well exposed to light.

Station L was located at the north extremity of the island in the west end of the larger pond. The water here was never shaded, about three inches deep, and usually turbid. Collections were not made here until March. Throughout this month, the ciliates *Glaucoma scintillans*, *Spirostomum ambiguum*, *Coleps hirtus*, *Aspidisca costata*, *Colpidium colpoda*, and *Peridinium tabulatum* were frequent in collections.

STATION M.

Fine, black sediment in clear, slowly moving water, well lighted for part of the day.

This station was located at the extreme east end of the larger pond, close to the outlet from the smaller pond. The sun shone here most of the afternoon. The water was clear, always moving slowly, and the bottom was covered with fine, black sediment. A few collections of this sediment were made in March. *Lacrymaria olor*, *Amoeba villosa*, *Cochliopodium bilimbosum*, and *Heterophrys* sp.? were common in this material.

SYSTEMATIC REVIEW OF THE SPECIES TAKEN.

Class Sarcodina.

SUBCLASS RHIZOPODA.

ORDER AMOEBIDA.

Family Amoebidæ.

Amoeba limax Dujardin (?)

Throughout the period of study this form was abundant among the algae growing on the sides of the bowl of the spring (Station J), and on the sand at the point where the spring water enters the larger pond (Station E). The writer was unable to see, even with the aid of a 1.8 mm. oil immersion lens, the radiating fringe of delicate substance at the posterior end of the animal which Penard regards as distinctive of the species. The measurements given by Cash (1905) are 50–60μ; Penard gives the maximum length as 80μ. The animals taken in Mirror Lake varied in length from 29–80μ.

Material collected on March 22 contained an abundance of amebæ of the *limax* form; five days later the same material showed only amebæ with numerous short radiating pseudopodia and these were about as abundant as the *limax* form had been. Max Verworn (1896) has shown that by the use of appropriate chemicals, *Amoeba limax* may be made to assume a *proteus* form and then a *radiosa* form. Doflein (1907) obtained similar form changes in *Amoeba vespertilio*, and showed that the body form and character of the pseudopodia were quite inadequate features for distinguishing the species of *Amoeba*, depending as they do upon the conditions of the environment and the nature of the medium. The writer's observation might therefore indicate, although the evidence is by no means conclusive, that the *Amoeba limax* discussed above and the *Amoeba radiosa* named below may be different phases of the same species.

Amoeba proteus (Pallas).

This animal was present only in a very few collections made late in November and early in December. It was taken in algae from submerged rocks at Stations E and G.

Diameter 119–193μ.

Amoeba sp.?

A small, very hyaline ameba of the *proteus* type was common among the algae in the bowl of the spring (Station J), at the point where the spring water flows into the larger pond (Station E), on alga-covered poplar roots (Station D), and on algae from a submerged stone (Station G). It was taken from November to the end of February.

Diameter 32–80μ.

Amoeba radiosa Dujardin.

This species was common in all collections from the bowl of the spring (Station J). It was taken in algae at Stations F, I and I', but occurred at these places only infrequently.

Diameter of body 21–48μ; length of pseudopodia 84μ and less.

Amoeba verrucosa Ehrenberg.

Juvenile and adult forms of this species were common from November to the end of January in a few collections of algae from Station G. They were taken occasionally at the entrance of the spring into the larger pond (Station E) and on the alga-covered poplar roots at Station D.

Diameter 59–104μ.

Amoeba villosa Wallich.

This species was common during February and March in the bowl of the spring (Station J) and on the fine black sediment at Station M.

Length 122–144μ.

Biomyxa vagans Leidy. Pl. II, Figs. 1, 1a and 1b.

One individual was taken in early November among alga-covered poplar roots at Station D. At first glance it appeared to be some non-living substance which was becoming flattened out, due to the weight of the cover glass. It moved slowly and constantly, never keeping the same form two consecutive moments; and the pseudopodia, which were hyaline, were very difficult to see. One ellipsoidal granular nucleus could be distinguished but the animal was not stained so that the presence of other nuclear material in the cell was not determined. Penard (1902) described some individuals with one globular,

distinctly granular nucleus, others with a half dozen or more ellipsoidal nuclei. The extended individual, (Pl. II, Fig. 1), measured 360μ.

In February several smaller animals of the same species were taken at the entrance of the spring into the larger pond (Station E). In these the pseudopodia were very numerous, long, and anastomosing, and the contractile vacuole could easily be seen.

Length of individual shown in Plate II, Fig. 2, is 144μ.

Family Arcellidæ.

Arcella vulgaris Ehrenberg.

This species was taken throughout the period of study but only in occasional collections of alga-covered poplar roots from Station D. It was rare in new material, but increased rapidly in standing cultures. The individuals varied greatly in size and were light brown in color.

Breadth of shell 48–133μ; diameter of mouth 25–59μ.

Difflugia globulosa Dujardin.

This species occurred throughout the period of study at a variety of stations in the lake. It was abundant in sediment from Stations F and K, among algae at Stations I and I', and on sediment from Station B. The animal multiplied rapidly in a standing culture.

Length 72–144μ; breadth 80μ.

Difflugia lobostoma Leidy.

This form was common only in December among algae taken at the point where the spring water enters the larger pond (Station E). It was infrequent in November and January among the dead *Oedogonium* (Station H), among floating algae from Station C, and in sediment and algae from Stations K and L.

Length 54–82μ.

Difflugia acuminata Ehrenberg.

One individual was taken in February among algae scraped from a submerged stone at Station G. Its length was 219μ and the diameter of the mouth was 48μ. A much smaller specimen was found among dead *Oedogonium* (Station H), in March.

Length 72μ.

Difflugia pyriformis Perty.

This species was taken late in January in floating *Spirogyra* from Station C, in which it was abundant. It had become plentiful about this time in a culture containing dead *Oedogonium* taken at Station H which had been standing four months.

Length 40–208μ.

Difflugia corona Wallich.

One individual was taken late in October in floating *Spirogyra* (Station C). The animal occurred abundantly late in January on the sediment at Station F, which is very close to the preceding station. All were very active and had a pair of widely divergent spines on the fundus.

Diameter of the shell 128–176μ; length of spines 48μ.

Centropyxis aculeata (Ehrenberg).

This form was not recorded from fresh collections, but was found abundantly in material from three different stations, that had been standing in the laboratory for two months. This material consisted of alga-covered poplar roots from Station D, algae from spring water at Station E, and sediment drained from leaves in the smaller pond (Station A). Some of the shells were made up mostly of sand grains; and in others, the chitinoid shell was impregnated with only a few grains of sand. Three, six or seven spines were present on the fundus.

Length 112–117μ.

Lecquereusia modesta Rhumbler.

One individual was taken in March among algae scraped from a submerged stone at Station G. The shell was impregnated with a large number of sand grains.

Length of shell 112μ; breadth 90μ.

Euglypha brachiata Leidy.

This species was common among alga-covered poplar roots (Station D) from November to the end of January.

Length 80–88μ; breadth 32μ.

Euglypha ciliata (Ehrenberg).

One individual was taken from Station G, where algae were scraped from a submerged stone. The collection was made late in January.

Length 64μ.

Trinema enchelys (Ehrenberg).

This species was infrequent in a collection of alga-covered poplar roots taken late in November from Station D.

Length 36μ; breadth 16μ.

Cyphoderia ampulla (Ehrenberg).

This form was rare in one collection made on January 30 at the point where the spring water enters the larger pond (Station E).

Length 128μ; breadth 48μ; diameter of mouth 14μ.

Pamphagus hyalinus (Ehrenberg).

On the sand at Station F in December, this form was abundant. The pseudopodia were altogether hyaline.

Diameter 32μ.

Cochliopodium bilimbosum Auerbach.

This species was abundant during February in algae from the bowl of the spring (Station J). Late in March it was common on the fine black sediment at Station M.

Diameter 25–48μ.

SUBCLASS HELIOZOA.

ORDER APHROTHORACIDA.

Actinophrys sol Ehrenberg.

Throughout the period of study, this form was abundant in the bowl of the spring (Station J), at the point at which the spring water enters the larger pond (Station E), and in algae from a submerged stone at (Station G).

Diameter 45–80μ.

Actinosphaerium eichhornii Stein.

Five individuals of this species were taken, but no two of them from the same station. In the latter part of October, the largest specimen was taken on the green sediment at Station A, another was found on the black sediment at Station B, and still another one occurred on the bottom at Station F. In November, an individual was taken in floating *Spirogyra* (Station C) and another on the sand at Station E.

Diameter 119–608μ.

Nuclearia delicatula Cienkowski.

Several individuals were taken on December 3 among algae at Station E. They were similar to Leidy's figures of *Heterophrys myriapoda*, (1879; Pl. 46, Figs 4 and 7). The latter name has been shown by Cash (1905) to be synonymous with *Nuclearia delicatula*.

Diameter 40μ.

Nuclearia sp.?

This form was abundant among algae from the bowl of the spring during the entire time that material was taken from this station. The individuals were very often colored a bright yellow and agreed with Leidy's figures, (1879; Pl. 15, Figs 2 and 3, and Pl. 16, Fig. 13), of *Heterophrys* sp.? Cash (1905) has shown this genus to be synonymous with *Nuclearia*.

Diameter 64–90μ.

ORDER CHALARATHORACIDA.

Raphidiophrys viridis Archer.

Throughout the period of study this species was taken at a variety of stations, but occurred abundantly only at Stations I and I', in algae scraped from submerged posts.

Diameter 43–80μ.

Raphidiophrys pallida Schulze.

Late in November and early in December this form was common among alga-covered poplar roots (Station D). The spicules on the animal were very long and numerous.

Diameter 96μ.

Acanthocystis sp.?

This species was abundant during December and January among algae scraped from posts at Stations I and I', and it was taken also on alga-covered poplar roots at Station D. The animals taken in Mirror Lake were very similar to Leidy's figures, (1879; Pl. 43, Figs 14 and 16).

Diameter 53μ.

Acanthocystis sp.?

Several individuals were taken on December 3 among floating algae from Station C. These agreed perfectly with Leidy's figures of *Acanthocystis* sp.? (1879; Pl. 43, Fig. 8).

Diameter 32μ.

Diplophrys archeri Barker.

Early in March one colony was observed among dead *Oedogonium* filaments from Station H. It was ruby red in color with colorless pseudopodia. The animal moved steadily across the field.

Diameter 48μ.

Class Mastigophora.

SUBCLASS FLAGELLIDIA.

ORDER MONADIDA.

Family Heteromonadidæ.

Monas fluida Dujardin.

An individual was taken on October 24 in green sediment on the leaves at Station A. It contained numerous refractive bodies and it was very metabolic.

Length of the extended form 36μ.

Anthophysa vegetans Müller.

One colony of eight individuals occurred in floating *Spirogyra* (Station C) late in October. This species was not seen again until late in March when it was abundant in algae at Station G. The colonies were 48μ in diameter.

Streptomonas cordata (Perty).

This species was common during December in alga-covered poplar roots (Station D) and among algae growing at the point at which the spring water enters the larger pond (Station E).

Length 15μ.

Order Euglenida.

Family Euglenidæ.

Euglena acus Ehrenberg.

This form was found in a culture of algae taken from a submerged stone (Station G) in the early part of December. The culture had been left standing in the laboratory for nearly two months.

Length 80–144μ; breadth 10μ.

Euglena acus Ehrenberg, variety **rigida** Hübner.

One individual was taken in sediment from Station B in late November. It was characterized by the spiral arrangement of the rod-shaped paramylum grains and the greater rigidity of the cell. There were twelve paramylum grains in the specimen taken.

Length 120μ; breadth 11μ.

Euglena deses Ehrenberg.

During October and November, this form was taken occasionally among floating *Spirogyra* (Station C) and in sediment from Station F. During the two months that ice covered Mirror Lake, the species was not taken. Late in February and throughout March, it was common in algae from Station H and from submerged posts (Stations I and I′).

Length 112–116μ; breadth 12–19μ.

Euglena gracilis Klebs.

This form was common in one collection of algae growing on poplar roots (Station D) taken in January. The organisms showed a peculiar kind of metabolic movement; the posterior end of the cell was very active while the anterior half remained motionless.

Length 40–46μ.

Euglena granulata (Klebs).

This species was exceedingly abundant in a two months old culture of algae taken from a submerged stone (Station G) early in December.

Length 80–88μ; breadth 24μ.

Euglena oxyuris Schmarda.

This organism was common in the same two months old culture that contained the *Euglena granulata*. The forms were considerably smaller than those described by Lemmermann (1913).

Length 192–200μ; breadth 24–26μ.

Euglena torta Stokes.

One individual was taken in December on alga-covered poplar roots (Station D).

Length 64μ.

Euglena viridis Ehrenberg.

This form was common in November in algae from Station H, in December among alga-covered poplar roots (Station D), and on March 1, among sediment and algae on the stone near the outlet of the larger pond (Station K).

Length 56–61μ.

Trachelomonas intermedia Dangeard.

This species was infrequent among filaments of dead *Oedogonium* from Station H taken in the early part of March. It moved very swiftly and was bright red in color.

Length 24μ; diameter 18μ.

Trachelomonas volvocina Ehrenberg.

Early in December this form was common among floating *Spirogyra* (Station C). The organism was almost spherical.

Length 20μ.

Phacus alata Klebs.

This form was common in a culture of algae taken on December 3 from Station G, which had been standing two months.

Length 19μ; width, the same.

Phacus longicauda Ehrenberg.

This species was infrequent in collections but was taken regularly throughout October, November and December, in floating algae from Station C, in sediment from Station F, and in material scraped from a submerged stone at Station G.

Length 80μ; width 32μ.

Phacus pyrum Ehrenberg.

This organism was common among algae scraped from a submerged stone (Station G) which had been taken early in December and left standing in the laboratory for two months.

Length 48μ.

Cryptoglena pigra Ehrenberg.

This minute, active species was abundant in the same material which contained the preceding form.

Length 15μ; breadth 9μ.

Family Peranemidæ.

Peranema trichophorum Ehrenberg.

This form was infrequent in newly collected algae from the bowl of the spring (Station J) and in floating *Spirogyra* from Station C. It became very abundant however in a two weeks old culture.

Length 32–80μ.

Heteronema acus Ehrenberg.

Late in October one individual was taken in algae from Station E. The cell was not perceptibly striated and the main flagellum was as long as the animal, while the trailing one was only half as long.

Length 112μ; width 32μ.

Anisonema acinus Dujardin. Pl. III, Fig. 1.

More than one individual of this species was never taken in a collection. It was taken in floating *Spirogyra* (Station C), on alga-covered poplar roots (Station D), and in algae from Stations H, I and I', throughout the period of study. This form is ordinarily described and figured with the nucleus situated on the right side, opposite that on which the contractile vacuole is located. In several individuals which the writer observed (see Pl. 3, Fig. 1), the nucleus was on the left side, that is, on the same side with the contractile vacuole.

Length 26–32μ; breadth 16μ.

ORDER PHYTOFLAGELLIDA.

Family Chrysomonadidæ.

Dinobryon sertularia Ehrenberg.

Early in October in the green sediment from the leaves at Station A these colonies were abundant. One colony was taken in November in algae scraped from submerged posts (Stations I and I′).

Synura uvella Ehrenberg.

This colonial protozoan was common throughout the fall in sediment from Station B and it was common in one collection of filaments of dead *Oedogonium* (Station H) in November. Many colonies contained only eight individuals, others as many as 32.

Diameter of colony 56–128μ.

Family Cryptomonadidæ.

Cryptomonas ovata Ehrenberg.

This species was abundant in March among *Oedogonium* filaments at Station H, in sediment from the stone near the outlet of the larger pond (Station K), and on alga-covered poplar roots (Station D). It was not seen during the time when ice covered the lake.

Length 56μ.

Chilomonas paramaecium Ehrenberg.

Although infrequent in new collections of floating *Spirogyra* (Station C), and in algae scraped from the posts (Stations I and I′), it was very abundant in cultures which had become foul. It multiplied rapidly as decay proceeded and the bacteria increased.

Length 21–27μ; width 9–11μ.

Family Chlamydomonadidæ.

Carteria multifilis (Fresenius).

This minute green flagellate caused the water in the smaller pond to assume a bright green color during a few days in October. Some interesting observations were made on its behavior in relation to light. During the day the organisms tended to

congregate in those parts of the pond lighted by the sun. The water in the lighted part of the pond was of a bright green color, while in the shaded parts, a green tinge was scarcely noticeable. On days when the sky was overcast with clouds the cells settled to the bottom and formed a thick green sediment on the leaves. After a heavy rain and wind storm on October 29, these organisms were not found. *Carteria multifilis* was present in floating *Spirogyra* in the larger pond (Station C) during October; its numbers were not nearly so great, however, as in the smaller pond.

Diameter 9–15μ.

ORDER DINIFERIDA.

Family Peridinidæ.

Peridinium quadridens Stein.

One individual was taken in algae from a submerged stone at Station G on December 18, and another in sediment from Station L in March. The environments were very similar at these places.

Length 40–43μ.

Peridinium tabulatum Ehrenberg.

This organism was common in sediment from Stations H and F until on December 7 a sudden drop in the temperature caused ice to form on the lake. It was taken again at the same place after thawing, but only rarely.

Length 40μ.

Gonyaulax polyhedra Stein.

Not until March did this form appear in collections. It was common in algae from posts (Stations I and I′), in filaments of *Oedogonium* (Station H), and in algae from a stone (Station G).

Length 34–48μ.

Glenodinium cinctum Ehrenberg.

One individual was taken in March in algae scraped from the submerged stone at Station G. The eye spot was unusually large.

Diameter 30μ.

Class Infusoria.

SUBCLASS CILIATA.

ORDER HOLOTRICHIDA.

Family Enchelinidæ.

Enchelydon farctus Claparede and Lachmann.

One individual was taken on March 21 in algae scraped from a submerged stone (Station G).

Length 224μ.

Pseudoprorodon niveus (Ehrenberg).

One individual was found on December 3 among dead filaments of *Oedogonium* at Station H.

Length 192μ; breadth 96μ.

Prorodon teres Ehrenberg.

This species was common throughout January and February in alga-covered poplar roots (Station D), and nearby in algae from a submerged stone (Station G). The form of the animal varied considerably, some individuals being much more elongate than others.

Length 240–282μ.

Lacrymaria olor Müller.

This form was rare in collections, but was widely distributed in the lake. Throughout the period of study it was taken in sediment from Station B, among algae, both from a submerged stone at Station G and on submerged posts (Stations I and I′) and in the bowl of the spring (Station J). It was found also in sediment at Station M. The actions of the organism are very interesting. The flask-shaped body usually lies hidden among debris while the exceedingly elastic neck violently waves about in search of food.

Length of the contracted animal 112–143μ; the extended form 512μ.

Coleps hirtus Ehrenberg.

This species was more frequently recorded perhaps than any other of the Protozoa. It was taken throughout the period of study in algae at Stations C, D, E, G, H, and L. The animal

multiplied rapidly in laboratory cultures, especially in those containing *Euglenæ*, which seem to be an important item in the food of *Coleps*. Dividing individuals were always common.

Length 45–64μ; diameter 22–35μ.

Didinium nasutum (Müller).

One individual was taken in February on alga-covered poplar roots at Station G.

Length 83μ.

Family Trachelinidæ.

Amphileptus anser Ehrenberg.

After the material had stood in the laboratory two weeks, several individuals were found in algae from Station G, taken on January 24.

Length 208μ.

Lionotus fasciola (Ehrenberg).

This organism was common throughout the period of study in algae from Stations D and G.

Length 112–370μ.

Lionotus varsaviensis Wrzesniowski.

One individual was taken on March 7 in sediment from a stone near the outlet of the larger pond (Station K).

Length 96μ.

Lionotus vermicularis Stokes.

More than one individual of this species was never taken in a collection, but it was taken during the entire period of study. It was found in sediment at Station F, in algae from a submerged stone (Station G), and at the point where the spring water enters the larger pond (Station E). The writer was interested in observing the manner of feeding. The animal moved slowly along, came in sudden contact with a *Coleps*, which almost immediately became motionless. The small ciliate was then sucked down through the gullet of the *Lionotus*. The digestive juices acted so quickly that after fifteen minutes, *Coleps* could not be distinguished from the surrounding protoplasm.

Length 400–666μ.

Lionotus wrzesniowskii Kent.

This species was common in one collection, that of November 13, of algae growing at the point where the spring water enters the larger pond (Station E).

Length 518μ.

Loxodes rostrum Ehrenberg.

This organism was very abundant during the fall in sediment at Station B, where it utilized the plentiful *Carteria* cells for food. Many of the animals were strangely distorted; some were extremely concavo-convex ventro dorsally; in many others the protoplasm was protruded on various parts of the cell. The organisms were apparently little inconvenienced, and their behavior was unmodified except for a peculiar movement, which consisted of a revolution to the right on the longitudinal axis.

Length 160–288μ; breadth 48–80μ.

Family Chlamydodontidæ.

Nassula ornata Ehrenberg.

This species was common during November only, on alga-covered poplar roots (Station D). The cells were scarcely colored, but contained many food vacuoles.

Length 250–296μ; breadth 118–148μ.

Chilodon cucullus (Müller).

This form was infrequent in algae from the bowl of the spring (Station J) and in algae from Station E. It became abundant in February at these places. About this time it was common in sediment from a stone near the outlet of the larger pond (Station K) and in algae taken from submerged posts (Stations I and I′).

Length 112–208μ.

Chilodon fluviatilis Stokes.

This form was common during December in algae at Station H and in sediment from Station A.

Length 60μ.

Chilodon megalotrochæ Stokes.

This species was abundant in one collection of algae from Station E, taken on January 7.

Length 32μ.

Chilodon uncinatus Ehrenberg.

On January 24, this form was abundant in algae at the point where the spring water enters the larger pond (Station E).

Length 21μ.

Chilodon vorax Stokes.

This species was common on February 9 on alga-covered poplar roots at Station D, and in algae at Station E.

Length 128–176μ.

Family Chiliferidæ.

Glaucoma scintillans Ehrenberg.

This attractive organism, though common during February and March, in newly collected algae from submerged posts (Stations I and I′), and on alga-covered poplar roots, became very abundant in those cultures after decomposition had set in.

Length 48–64μ.

Frontonia leucas (Ehrenberg).

This form was abundant in sediment drained from leaves at Station A, during October and November. The organisms were brightly colored because of the presence of ingested diatoms and *Carteria* cells.

Length 288–400μ; diameter 80–112μ.

Frontonia sp.?

This organism was abundant in *Oedogonium* filaments (Station H) and in algae from submerged posts (Stations I and I′).

Length 144–160μ; breadth 96–112μ.

Ophryoglena sp.?

Several individuals similar to Figure 221 of Conn (1905) were taken on alga-covered poplar roots at Station D, on February 9.

Length 112μ.

Ophryoglena atra Ehrenberg.

This species was common among alga-covered poplar roots (Station D) on January 7.

Length 144μ.

Colpidium colpoda (Ehrenberg).

This form was abundant during January and February in algae at Station G; during March it was common in sediment from the stone near the outlet of the larger pond (Station K).

Length 90–112μ.

Loxocephalus granulosus Kent.

This animal was abundant late in October in algae taken from Station E. There were two adcurved setae near the anterior end of the cell. In this and other respects, the specimens seen agreed with the description and drawing of Kent (1881). The ring of larger cilia figured and described by Bütschli (1883–88) was not seen.

Length 50μ; breadth 15μ.

Colpoda sp.? Pl. III, Figs 2 and 2a.

This organism was found in algae from a submerged stone at Station G on December 3. An attempt to place it in described species failed. The cell is broadly oval, slightly tapering at the anterior end and covered by numerous fine cilia arranged in rows. A gullet lined with cilia occupies a position a short distance from the anterior end. The meganucleus is large, rounded and situated posterior to the gullet. The micronucleus lies in contact with the meganucleus; both these bodies were plainly visible even in the unstained specimen. A large contractile vacuole occupies the posterior part of the cell.

Length 89μ; breadth 74μ.

Family Urocentridæ.

Urocentrum turbo (Müller). Pl. III, Fig. 6.

This species was abundant during October in sediment drained from the leaves at Station A, and in the black sediment of Station B close by. In November it was common in floating algae from Station C; in February it was common only on alga-covered poplar roots (Station D). Several pairs of individuals taken in February presented the appearance shown in outline

in Figure 6 on Plate III. The writer was unable to observe them long enough to determine whether the process was one of longitudinal division, which to the writer's knowledge is undescribed for this species, or of conjugation.

Length 63μ; breadth 46μ.

Family Microthoracidæ.

Cinetochilum margaritaceum (Ehrenberg).

In December, this organism was common in algae from Station G. It was not found again until late in March when it was abundant in sediment at Station L, at the opposite end of the larger pond.

Length 24μ.

Family Paramaecidæ.

Paramaecium bursaria (Ehrenberg).

This species was infrequent on alga-covered poplar roots (Station D) and among dead *Oedogonium* filaments (Station H), from November to the end of February. All the individuals were colored bright green by numerous *Zoochlorellæ*.

Length 122–153μ.

Paramaecium caudatum Ehrenberg.

This well-known species, usually found in hay infusions, was most common in those parts of Mirror Lake made foul by decaying organic matter. It was common in newly collected material, but soon became abundant in a culture when the growth of bacteria was at its height. It was taken in the black sediment at Station B throughout the fall. During January, February and March it was abundant on alga-covered poplar roots, (Station D), and in algae at Station G, H, and E.

Length 320–352μ; diameter 80μ.

Family Pleuronemidæ.

Lembadion bullinum (Müller).

This form was common during November among dead *Oedogonium* filaments (Station H). One individual was taken in December and another in January among algae from the submerged stones at Station G.

Length 128μ.

Pleuronema chrysalis (Ehrenberg).

This species was abundant throughout the period of study in all collections from Stations G and H. It multiplied rapidly in a standing culture. In the fall and again late in March it was abundant among floating algae at Station C and in sediment at Station F.

Length 70–102μ.

Cyclidium glaucoma Ehrenberg.

This protozoan was abundant in November among alga-covered poplar roots (Station D), in January, in algae from the bowl of the spring (Station J), and in February, on algae growing on the rocks at the point where the spring water enters the larger pond (Station E). In all these places the water was clear and fresh. The movements of the animal which are very quick and jerky, recall those of water striders.

Length 24μ.

ORDER HETEROTRICHIDA.

Family Plagiotomidæ.

Spirostomum ambiguum Ehrenberg.

This very large protozoan was common in the black sediment at Station B; it was taken here only during October and November. Late in March, several individuals were found in sediment at Station L.

Length 296–1280μ; breadth 30–144μ.

Metopus sigmoides Claparede and Lachmann.

This species was common in the fine black sediment at Station M, at which collections were made only in March. A few individuals were taken among *Oedogonium* filaments (Station H) about the same time.

Length 90μ.

Family Bursaridæ.

Busaria truncatella Müller.

One individual was taken in March in algae from submerged posts (Stations I and I′).

Length 224μ.

Family Stentoridæ.

Stentor coeruleus Ehrenberg.

This organism was taken throughout February at Station D, where the collections consisted of algae from a submerged stone. The animals could plainly be seen without a lens. They were common in new collections, but multiplied so rapidly that in a culture two days old, a blue scum, consisting entirely of these organisms, covered the plant material.

Length of extended animal sometimes as great as 3 mm.

Stentor polymorphus (Müller).

This form was common during the fall in sediment from Station A and on the alga-covered poplar roots (Station D). In March, several individuals were found in algae on the stone near the outlet of the larger pond (Station K) and from submerged posts (Stations I and I′).

Length of the contracted form 226μ; extended form 880μ.

Stentor roeselii Ehrenberg.

This form was abundant in collections made from December to the end of March. It was taken among algae from the submerged stone (Station G), in algae scraped from posts (Stations I and I′), and among algae growing on the rocks at the point at which the spring water enters the larger pond (Station E). Two individuals were often seen to occupy the same sheath.

Length of the extended forms 720–1440μ.

Caenomorpha medusula Perty.

Several individuals were taken on December 3 among algae from a submerged stone at Station G. One was found on the last day of January at the same place.

Length 104μ.

Family Halteriidæ.

Strombidium gyrans Stokes.

This species was common from October 10 until ice covered the lake, when it occurred rarely, but became common again after the thaw late in February. It was taken during the fall in the smaller pond in sediment at Station A, and in January, among algae from the submerged stone at Station G, on the posts (Stations I and I′), in the same material taken from the

stone near the outlet of the larger pond (Station K), and on alga-covered poplar roots at Station D. The animal darts in such an extremely erratic manner as to defy examination. Fortunately, it has the habit of temporarily attaching itself by the posterior end and becoming somewhat quiescent, but even then it rotates on the longitudinal axis.

Length 63μ.

Strombidium typicum (Lankester).

An individual was found in each of the two collections made in January, one of alga-covered poplar roots (Station D) and one of algae from the submerged stone (Station G) very close by.

Length 126μ.

Halteria grandinella (Müller).

Several individuals were taken on alga-covered poplar roots (Station D), collected during December and January. On March 1, the form was common in sediment taken from the stone near the outlet of the larger pond (Station K).

Length 48μ.

Strombidinopsis sp.? Pl. III, Figs. 3 and 3a.

One individual was found in algae from a submerged stone at Station G, on December 3. It was free swimming, vase-shaped and nearly six times as long as broad. The anterior margin was flaring and obliquely truncate; the cilia of the peristome were very long, powerful and bent forward, forming a spiral wreath of two turns, which extended into the oral fossa. Posteriorly the cell was broadly rounded and terminated in a short conspicuous, eccentric acumination. The cilia of the cuticular surface were short, sparse, fine and arranged in longitudinal rows. The cell was hyaline and the animal's movements were rapid.

Length 118μ.

Family Tintinnidæ.

Tintinnidium fluviatile (Stein).

On March 22, one individual of this species was found on algae from the submerged stone at Station G. The lorica contained many foreign particles which made it appear rough.

The animal's movements were very erratic. It would dart swiftly in one direction, then like a flash, whirl directly about and move in the opposite direction. After coming to rest, it would occasionally project from the lorica, then almost immediately withdraw into it again.

Length of lorica 64μ.

ORDER HYPOTRICHIDA.

Family Oxytrichidæ.

Urostyla grandis Ehrenberg.

This species was common in February in algae from a submerged stone at Stations G and K. Late in March it was taken in sediment near the outlet of the larger pond (Station K).

Length 176–400μ; breadth 128μ.

Stichotricha sp.? Pl. III, Fig. 5.

This form appeared in a three months old culture of floating *Spirogyra* from Station C, collected on October 31. The animal was flask shaped, its anterior two thirds attenuate and neck like; the peristomial field, fissure-like and extending two-thirds of the way to the posterior end and edged by remarkably long cilia. Two oblique rows of ventral setæ were present. A large vacuole situated on the right side a fourth of the distance from the posterior end pulsated rhythmically. The writer was unable to identify this organism with any of the described species of the genus *Stichotricha*.

Length 144μ.

Uroleptus dispar Stokes.

One individual was taken on March 15 among filaments of *Oedogonium* at Station H.

Length 176μ.

Oxytricha caudata Stokes.

This species was taken a very few times among alga-covered poplar roots (Station D) and at the point where the spring water enters the larger pond, during the fall. One was found late in February in sediment (Station B), and another on March 15, in algae from submerged posts at Stations I and I′.

Length 240μ.

Oxytricha pellionella Müller.

At the entrance of the spring into the larger pond, one individual of this species was taken on the last of October. Several were taken in the middle of December among algae from a stone (Station G).

Length 80μ; breadth 16μ.

Oxytricha platystoma (Ehrenberg).

This form was abundant in a three months old culture of floating *Spirogyra* taken at Station C on the last day of October.

Length 80–128μ.

Stylonychia mytilus (Müller).

This species was common throughout the period of study in floating algae at Station C, in algae scraped from the rocks at Station E, and on the alga-covered poplar roots from Station D. Frequently the organisms were brightly colored, because of the presence of diatoms and algae.

Greatest length 192μ; breadth 112μ.

————? Pl. III, Figs 9 and 9a.

This form was found on November 21 on alga-covered poplar roots at Station D. It is a hypotrichous ciliate and differs from the genus *Histrio* in that it lacks frontal and anal styles and the nuclear material is differently disposed. The animal is orbicular, obliquely truncate at the anterior and posterior ends, and persistent in shape. The anterior end bears an uninterrupted projecting fringe of large marginal cilia, which in a similar form extended along the reflected border of the peristome nearly to the posterior end. Five scattered ventral styles were present. Staining revealed one meganucleus, somewhat crescent-shaped and centrally located, and two very much smaller micronuclei of spherical form and situated to one side of the meganucleus. Another individual, with a greater number of ventral styles was taken a few days later. This observation leads the writer to suspect that the animals were developmental stages, perhaps of some well-known hypotrich.

Length 74μ.

Holosticha vernalis Stokes.

This form was abundant from the latter part of January through March among algae in the bowl of the spring (Station J), in those on the submerged stone at Station G and among the algae scraped from posts at Stations I and I′.

Length 112–160μ.

Family Euplotidæ.

Euplotes charon (Müller).

One individual was taken among floating algae at Station C, in October.

Length 80μ; breadth 62μ.

Euplotes variabilis Stokes.

One individual of this species occurred in sediment on the leaves at Station A during October.

Length 220μ; breadth 128μ.

Aspidisca costata (Dujardin).

This species ranks with *Coleps Hirtus* in its wide distribution and frequency in Mirror Lake. It was common throughout the period of study in every station where algae grew, except in the bowl of the spring and at its entrance into the larger pond. Immature stages were invariably present in the collections.

Length 38μ.

ORDER PERITRICHIDA.

Family Vorticellidæ.

Vorticella alba Fromentel.

This species was abundant in sediment from Station B during November; it was not taken again until late in February and then among alga-covered poplar roots (Station D).

Length of zooid 48–64μ.

Vorticella microstoma Ehrenberg.

But one individual of this species was taken, among alga-covered poplar roots (Station D), on January 8.

Length of zooid 62μ.

Vorticella citrina Ehrenberg.

Several individuals were taken with sediment at Station F on November 7. The cells were hyaline and the pedicle was about 12 times the length of the zooid.

Length of the zooid 57μ.

Vorticella nutans Müller.

Several individuals were found in a two weeks old culture of algae taken from a submerged stone at Station G on January 24.

Length of zooid 64μ.

Vorticella floridensis Stokes.

This species was common among algae from the submerged stone (Station G) during February. One occurred late in March in sediment from the stone near the outlet of Mirror Lake (Station K).

Length of zooid 80–90μ.

Vorticella elongata Fromentel.

One individual was taken among algae scraped from the posts (Stations I and I′) on March 1.

Length of zooid 64μ.

Vorticella aperta Fromentel.

One individual was taken among algae scraped from a stone (Station G) late in February.

Length 64μ; width of peristome 80μ; length of stalk 300μ.

Vorticella nebulifera Ehrenberg.

One individual was found in January in algae taken at the point where the spring water enters the larger pond (Station E). This organism was abundant late in February on alga-covered poplar roots from Station D.

Length of zooid 72–112μ.

Vorticella utriculus Stokes.

One individual was taken late in March on alga-covered poplar roots from Station D.

Length of zooid 37μ.

Epistylis flavicans Ehrenberg.

This species was common in floating *Spirogyra* (Station C), in algae from posts (Stations I and I′) and on alga-covered poplar roots from Station D. It was common throughout the period of study except during the month of January.

Length of zooid 208μ.

Vaginicola globosa (d'Udekem).

One individual of this species was found in algae from Station G. It was attached to the perisarc of the stalk of *Vorticella aperta*.

Length of lorica 48μ; of extended zooid 64μ.

Thuricolopsis innixa Stokes. Pl. III, Figs. 4 and 4a.

This form was taken on January 24, in algae from a submerged stone at Station G. When found, the animal was contracted and remained in this state for about two hours. During this time the nucleus was plainly visible and appeared narrow and band-like as shown in the figure. Food vacuoles formed rapidly after the organism became active. The writer has included drawings (Pl. III, Figs 4 and 4a) of this not very common ciliate, since no satisfactory drawing was found in any of the available literature.

Length of lorica 160μ; diameter 48μ; length of pedicle 10μ.

————? Pl. III, Fig. 8.

This organism shown only in outline in the figure indicated, was found in algae scraped from a submerged stone at Station G. The material was collected on December 3. It was apparently a hypotrichous ciliate, yet the presence of cilia other than those of the peristomial field was not determined. The animal was somewhat pear-shaped; the peristomial field extended about half way to the posterior end and was bordered by long, stout cilia. An oval nucleus occupied a central position in the cell. The oddest thing about the organism was the fact that it bore two exceedingly long cilia diagonally placed, and these waved continuously.

Length 36μ.

SUBCLASS SUCTORIA.

Family Podphryidæ.

Sphaerophrya urostylæ Maupas.

This animal was infrequent in one collection of algae taken on January 24 at the spring's entrance into the larger pond (Station E).

Diameter 48μ.

Podophyra libera Perty.

Several individuals were taken on February 21, among algae from a submerged stone (Station G). Some were conjugating. The nucleus was oval and coarsely granular; four contractile vacuoles were present. All the animals taken were without stalks. A young individual of this species is shown in Figure 7 on Plate III. The protoplasm was hyaline and the cell contained three contractile vacuoles.

Diameter of the largest 98μ.

Family Acinetidæ.

Acineta mystacina Ehrenberg.

This species was taken on December 3 in sediment from Station B, in February among algae from the submerged stone at Station G, during March in sediment from Station F and in algae from Station H. This species was the most common of the *Suctoria* in Mirror Lake. The tentacles were capable of great extension, often reaching 272μ in length. These were very efficient in paralyzing prey; and it was not uncommon to see a ciliate struggling at the end of a tentacle and after a time become motionless.

Diameter 48–56μ; length of lorica when present 128μ.

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EXPLANATION OF PLATES.

PLATE I.

Heavy Lines—Outline of Water.
Light Lines—Paths and Bridges.
Letters—Stations.
Scale—80 feet to the inch.

PLATE II.

(All the drawings on this plate are magnified 400 diameters).

Fig. 1. *Biomyxa vagans* Leidy. An active individual.
Figs. 1a and 1b. Different shapes assumed by the above animal.
Fig. 2. A smaller individual of the same species.

ABBREVIATIONS.

c. v.—contractile vacuole.
n.—nucleus.

PLATE III.

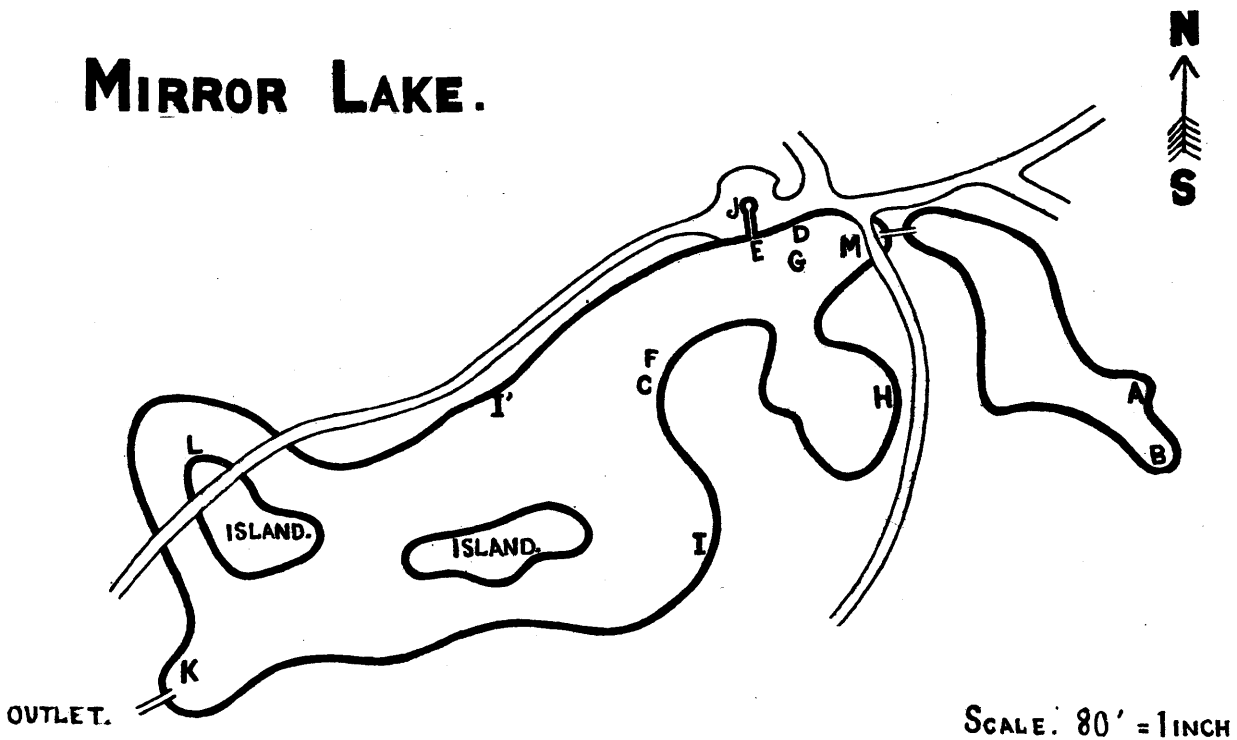
(All the drawings on this plate are magnified 400 diameters, except 9a, which is magnified 200 diameters).

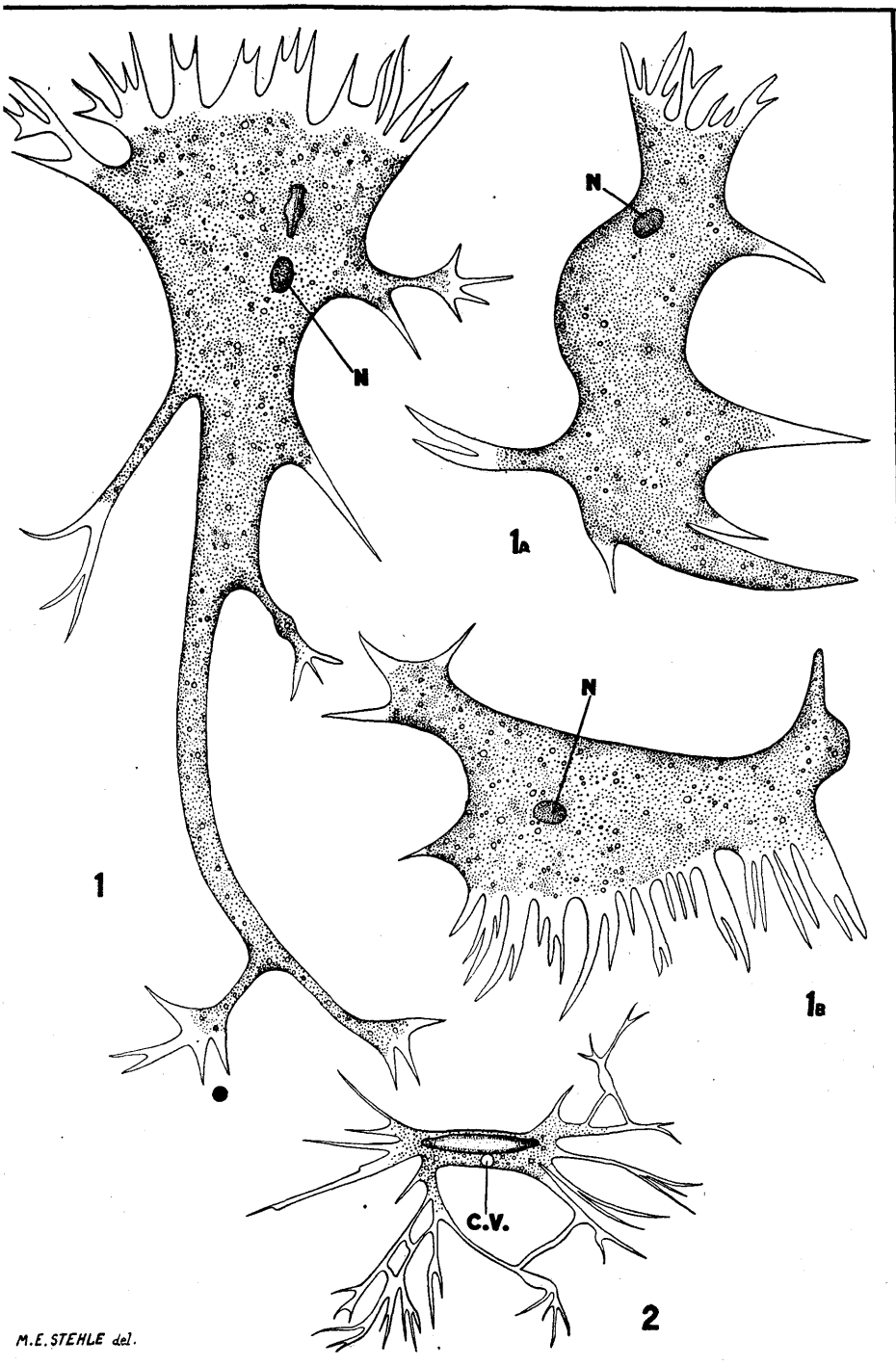
Fig. 1. *Anisonema acinus* Dujardin. An individual with the nucleus on the left side of the cell.
Fig. 2. *Colpoda* sp. Dorsal view of the animal.
Fig. 2a. A ventral view of the gullet of the same animal.
Fig. 3. *Strombidinopsis* sp.
Fig. 3a. The gullet in outline. It is on the opposite side from the view of the animal in Fig. 3, and can only be seen when the organism turns over.
Fig. 4. *Thuricolopsis innixa* Stokes. The expanded form with numerous food vacuoles.
Fig. 4a. A view of the contracted animal. The band-like nucleus plainly visible.
Fig. 5. *Stichotricha* sp.
Fig. 6. *Urocentrum turbo* (Müller). A pair of individuals in the act of conjugation (?) or of longitudinal division (?).
Fig. 7. *Podophrya libera* Perty. Juvenile stage.
Fig. 8. ———? Outline drawing of a hypotrichous ciliate with two very long diagonally placed cilia.
Fig. 9. ———? A hypotrichous ciliate with one crescent-shaped meganucleus and two micronuclei.
Fig. 9a. Outline of a side view of the above animal.

ABBREVIATIONS.

c. v.—contractile vacuole.
gul.—gullet.
f. p.—food particle.
megan.—meganucleus.
micron.—micronucleus.
n.—nucleus.

Mirror Lake.





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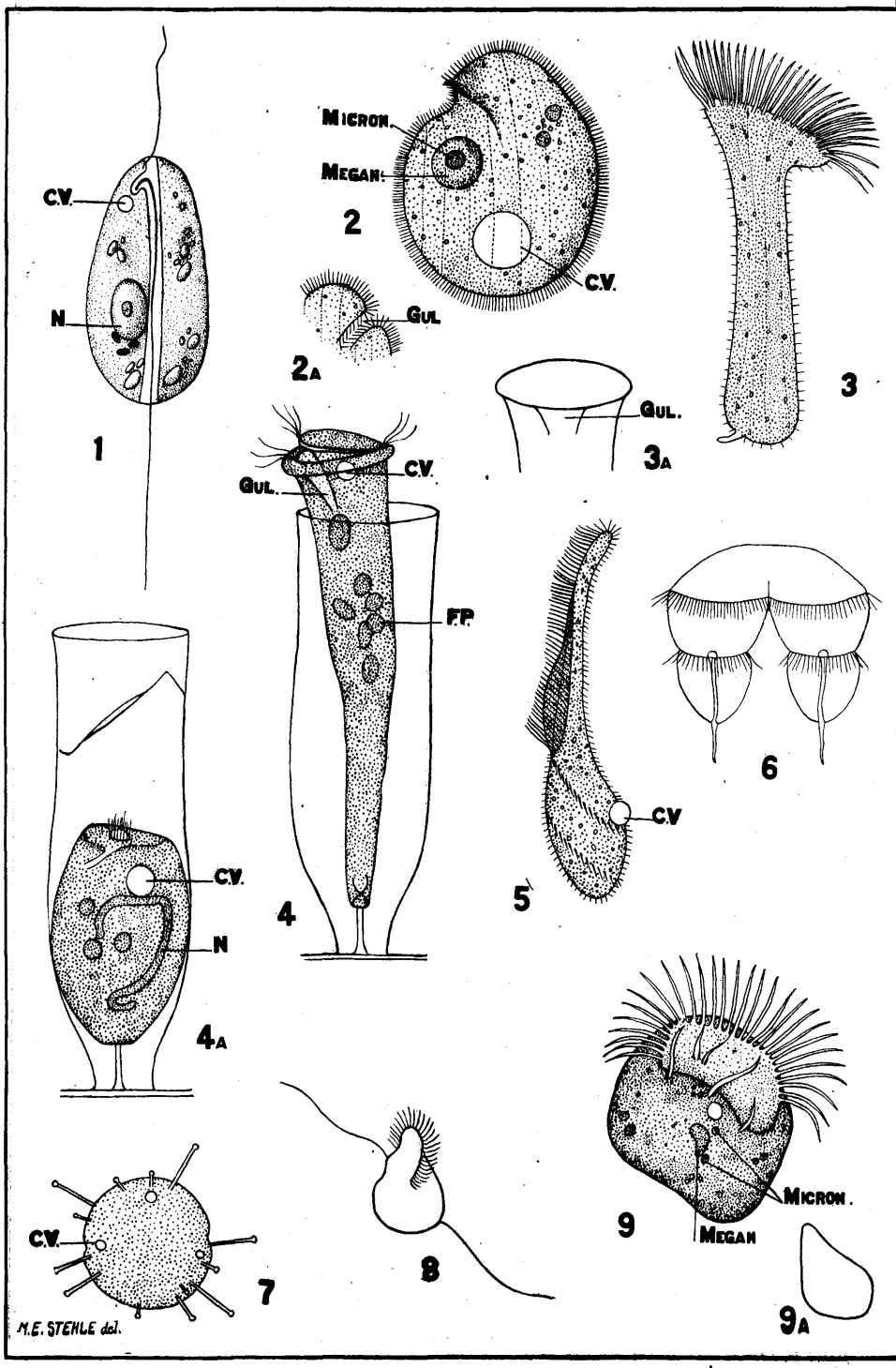

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